

ENURESIS UPDATED

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Enuresis is defined as: (a) repeated, involuntary voiding of urine by day or at night, (b) at least two such events per month for children between the ages of 5-6 years and at least one event per month for older children, and (c) not due to a physical disorder such as diabetes mellitus or a seizure disorder(1). The enuresis may be primary (child never achieved consistent dryness) or secondary (child had a period of dryness of atleast 3 to 6 months)(2-4).

Achievement of Urinary Control

It is important to review the steps taken by a child to achieve urinary control. An infant voids automatically that is, the detrusor responding to the stretch reflex con-

tracts and empties the bladder (detrusor micturition). The will does not influence the performance of this act. The infant at this stage shows no signs of having bladder sensations or desire to void. It can neither start nor stop the urinary stream at will. A child takes four steps in the transformation of infantile bladder, to obtain adult control of the urine(5).

The first step in the process is the awareness that the bladder is full. This occurs between the ages of one and two years and is due to the maturation of the parasympathetic nerves which carry bladder sensations. The child soon learns to communicate this. Toilet training should start around 1^{1/4} to 1^{1/2} years of age.

The second step is the ability to 'hold' urine for a brief time when the bladder is full or nearly so. This the child does through control of the levator ani and pubococcygens. The ability to hold urine, which is quite sketchy at first, improves in time and at about 3 years, day control becomes quite well established.

The third step is the ability to start the stream when the bladder is full. Here, the thoracic diaphragm and the abdominal musculature come into play. At this stage the detrusor is still very sensitive to stretch and it requires very little intrabdominal pressure for contraction. Most children have completed these 3 steps by the age of 4V2 years.

The fourth and last step is the ability to start the urinary stream at any degree of bladder filling. It requires the coordinate use of the thoracic diaphragm, the abdominal musculature, the levator ani, including

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the separate use of pubococcygeus.

Control over urination is achieved earlier in girls than boys. Therefore, the diagnosis of enuresis should be reserved for wetting beyond the age of 5 years in girls and 6 years in boys(3). Daytime control over urination is acquired earlier than that at night.

Epidemiology

Age: This common problem occurs in 30% of children at age 4, 10% at age 6, 3% at age 12, and 1% by age 18(4).

Sex: Most of the authors have reported that boys are affected more often than girls in a ratio of 1.5 : 1 to 2.0 : 1(2,6,7). Some workers, however, have observed higher incidence of enuresis among females(8,9).

Birth order: Enuresis has been reported to be more frequent in the eldest(9,10) child. This may be due to lack of proper knowledge and experience of parents about training in the first born baby.

Working Class Families: There are reports of more cases of enuresis among working class families(8,10) because working class parents can spare comparatively less time for care and training of children.

Socio-economic Status: Enuresis is found more frequently in low socio-economic classes(6,11), which is contradicted by other workers(9).

Maternal Factors: Literacy level of mother has no effect on incidence of enuresis(8). Enuresis has been reported to be more frequent in children whose mothers married at an early age(10). Bottle fed children suffer from enuresis more frequently as compared to breast fed children(8) perhaps due to less psychological mother-child bonding which may manifest as enuresis.

Intellectual Levels: Most of the studies have reported that there is no significant difference in the intellectual levels between children with enuresis and controls(4,8,10).

Sleep Pattern: Some investigators have reported that enuresis tends to occur during specific phase of sleep particularly as children rouse from the deepest stage of sleep(12).

Etiological Theories

1. *Genetic Theory:* Bakwin surveyed 338 pairs of same sex twins and found 95 pairs in which one or both were enuretic. The concordance for enuresis was significantly higher in monozygotic boy twins than among dizygotic boys, and when boys and girls were combined, concordance was significantly greater among monozygotic twins, again suggesting that heredity has some part in the origin of enuresis(4).
2. *Pathological Theory:* Some authors have asserted that enuretic children have a high prevalence of genitourinary anomalies(4) or abnormalities of the spinal cord(4). Obstructive lesions(4) of the distal outflow tract have received particular attention as both a cause of urinary tract infection and as an independent cause of enuresis(13). It has also been reported that the average functional capacity of an enuretic child's bladder is less than that of a normal child(13,14).
3. *Maturation Theory:* It suggests a failure of delay in maturation of central nervous system regulatory centres to inhibit the reflex bladder arc(15). The brain's control over micturition involves a series of cen-

tres that inhibit and excite bladder contraction, or mediate the perception of need and voluntary inhibition. The mechanisms of involuntary inhibition are so complex that defects of maturation could readily interfere with developing or maintaining continence(10). The theory is supported by: (a) a small functional bladder capacity (b) increased frequency of voiding urgency, (c) hereditary aspect and (d) high incidence of spontaneous cure.

4. *Psychological Theory*: The relationship between enuresis and psychological problems is intriguing. Many studies have reported more frequent occurrence of enuresis in children of younger mothers, in children whose mother had died or whose parents had separated or divorced, separation from mother or any other significant social and family stress(16). Overactivity, impulsivity, temper tantrums, nail biting, teeth grinding and other behavior symptoms are more often found in enuretic children. It seems unlikely that the behavior problems are a consequence of bedwetting since they often persist after children become dry(10). This theory is supported by the finding that the persistence of enuresis is more likely if: (a) the child shares bed with parents, (b) the parents pay a great deal of attention to the symptoms, and (c) the parents help to change the night clothes(4). There is an increased likelihood of enuresis in children having difficulty in behavioral adaptation, strict methods of training and parents with more anxiety and negative attitudes(4).
5. *Inadequate Toilet Training*: The more

frequent occurrence of enuresis among children having birth order one(8), children of working mothers(9), and large family size suggests that there is some role of inadequate toilet training in causation of enuresis. Enuresis as an isolated phenomenon may result from defective habit information during toilet training(4). Bregar(17) outlined four training difficulties that may lead to enuresis: (a) cultural lack of adequate training, (b) infantilizing, oversolicitous parents, (c) failure of parents to transmit the unacceptability of the wetting pattern, and (d) premature, excessive, punitive training. Thus forced training, smacking and scolding should be avoided. The pot should be untippable and comfortable.

Evaluation

Evaluation(13,18) and subsequent treatment are based on the pattern of enuresis, physical examination, urinalysis and urine culture. A careful history-noting the severity and type of enuresis, associated daytime voiding problems (diurnal enuresis, intermittent or weak stream, urgency, infrequent voiding), previous episodes of urinary tract infection, pertinent psychosocial and family history, problems with behavior and learning, and associated constipation or encopresis is the first step. Physical examination should include abdominal and genital examination, observation of the child voiding if the history suggests an abnormal stream, and neurologic evaluation including checking peripheral reflexes, evaluation of perineal sensation and anal sphincter tone, observation of gait and visual inspection of the lower back for evidence of sacral or cutaneous anomalies suggestive of a spinal abnormality. Alongwith, a detailed

psychological evaluation should be carried out.

Based on this initial evaluation, patients can be categorized as having either uncomplicated or complicated enuresis. Patients with nocturnal enuresis, a normal physical examination and negative urinalysis and urine culture findings have uncomplicated enuresis. No further evaluation is indicated in these patients.

In contrast, patients with a positive urine culture results or a history of urinary tract infection, abnormal neurological examination or history of significant voiding dysfunction have complicated enuresis. These patients constitute a minority of enuretic population and should be further evaluated with a renal bladder sonogram and voiding cystogram to exclude vesicoureteral reflux, bladder outlet obstruction, and hydro-ureteronephrosis associated with a thickened unstable bladder. The latter findings indicate the need for further urologic evaluation probably to include urodynamic evaluation. If the cause is not clearly identified, neurosurgical evaluation is indicated to exclude spina bifida occulta or a tethered spinal cord.

Treatment

The treatment of children with enuresis lacks agreement. The plethora of approaches to treatment points to the shortcomings of each of them. No single approach is consistently successful.

There is no objective evidence that withholding fluids in the evening, random awakening of the child to void or punitive measures result in significant cessation of enuresis. However, numerous therapeutic programs for uncomplicated nocturnal enuresis have been recommended that may be successful(2,13,19). These include:

1. Bladder Exercises

- (i) *Bladder Stretching*: Bladder stretching by voluntary prolonging the intervals between voiding is based on assumption that improvement in bladder capacity will improve or eliminate enuresis. This approach is useful in children over age 6 years with small bladder capacities and persistent detrusor instability of the infantile type(19). The normal bladder capacity can be estimated from the following formula(20).

$$\text{Bladder capacity (in ounces)} = \text{Age (in years)} + 2$$

or

$$\text{Bladder capacity} = 10 \text{ ml/kg.}$$

During the daytime the child can be encouraged to hold his urine as long as possible. If he feels the urge to go, he can be asked to do something to distract himself for 10 seconds or so it takes for the bladder contractions to stop. The urge may not occur again for 20 or 30 minutes. Help the child postpone responding as many times as possible. Give lot of fluids to the child upto 4 pm during the day. Have him urinate in to measuring cup, mark it. When he breaks an old record give him a special reward.

- (ii) *Stream Interruption*: Conscious stream interruption exercises and designed to increase the child's ability to withstand uninhibited bladder contraction(4) and are helpful in children with normal bladder capacity. Whenever a child goes to bathroom to urinate, have him stop his urine flow when his bladder is only half emptied. After counting to 10, he can proceed to

empty it the rest of the way. This should be done every time he urinates.

- (iii) *Increased Fluids Intake:* An increased fluid intake may be as important as voluntary urine retention for increasing functional bladder capacity(19).

2. Motivational Therapy(2,13)

Motivational therapy involves a series of counselling interviews during which the child is encouraged to assume responsibility for his or her enuresis and to be active participant in the treatment program(21).

3. Positive Reinforcement Therapy

The child is encouraged to assume responsibility for his or her own learning. A progress record is kept by the child, such as putting a gold star on a calendar for each dry night. It requires considerable input by supportive physicians and parents. It is important to clarify that the child is not at fault, and punishment for wetting is discouraged. A dry morning should receive some positive recognition. At a minimum the child should receive lavish words of praise from everyone in the family. A major breakthrough may warrant material rewards.

4. Behavior Modification (Conditioning) Therapy

Behavior modification therapy revolves around the use of signal alarm device that is electronically triggered as the child voids. The apparatus consists of a battery operated circuit with an alarm loud enough to wake a child from deep sleep. Two foiled electrodes separated by thin gauze are placed under the child. A small amount of urine closes the circuit by wetting the gauze in between the electrodes and sets off the alarm.

It is the treatment of choice for any enuretic child who has a small bladder, is unsuccessful at bladder stretching exercise, and cannot otherwise train himself to awaken at night(2). The child with a normal sized bladder who has failed with stream interruption exercise and positive reinforcement can also be considered for this technique.

The most important prerequisite for implementing the enuresis alarm is that the child is motivated. In a disinterested or too young child, treatment may fail. So it is used in patients over 8 years of age(18).

Initially the child awakens after or during voiding. A conditioned response for awakening and inhibition of micturition is gradually evoked by the association with bladder distension.

Long term success rates averaging 70% have been reported after 4 to 6 months of treatment(22). Relapse occurs in about 30% of patients, and is less likely after discontinuation of use after a 4 week dry period compared with a shorter dry period. Relapses respond to the enuretic alarm for a short period of additional time(2). A review of 18 published studies found an initial cure rates of 65-100% with a 9.5 relapse rate(23).

5. Pharmacologic Therapy

Several pharmacologic agents have been used to treat enuresis. What is needed is a safe drug that effectively treats children with small bladder capacities. Unfortunately no such drug exists at this time.

Pharmacologic therapy because of rapid onset of action, is indicated in special situations such as family vacations, camp or important slumber parties. In general the drugs should not be prescribed under 8 years of age(4). They should only be prescribed

in conjunction with motivational techniques and bladder exercises.

There appears to be no benefit from the use of sedatives, stimulants or sympathomimetic agents. Tricyclic antidepressants, particularly imipramine have been studied and used most extensively. The mechanism of action seems to be largely its anticholinergic effects, along with antidepressant action and alterations in arousal and sleep mechanism(2,13,18,24). The dose of imipramine is 50 mg at bedtime in 8-12 year age group and 75 mg for children over age 12. Larger doses do not seem to increase the success rate. The permanent cure rate is 25%. On weight basis, the recommended dose is 0.9-1.5 mg/kg/day(18).

The treatment should be continued for 3-6 months; after that a gradual weaning is done by reducing the dose and/or frequency over 3-4 weeks.

Side effects of imipramine include, tachycardia, stuffy nose, dryness of mouth, hypotension, constipation, increase in appetite, weight gain, precipitation of epileptic attacks in susceptible children and cardiac conduction abnormalities. Overdosage can cause potentially fatal toxicity with cardiac dysrhythmias and conduction block, hypotension and convulsions. Physostigmine therapy is used to manage life-threatening imipramine toxicity.

Anticholinergic Drugs (Oxybutynin): These drugs reduce or abolish uninhibited bladder contractions and may be particularly beneficial in patients who have day time urination frequency or enuresis associated with uninhibited bladder contractions, as manifested by urgency and urge incontinence(25). It is not very effective in exclusively nocturnal enuresis. The dose of oxybutynin is 5 mg bid or tid. Common side

effects include dryness of mouth and facial flushing. Excessive dosage may result in blurring of vision.

Antidiuretic Agents: Recently, desmopressin has been used in enuresis with promising results(2,18). The mechanism of action of this drug is a reduction in nocturnal urine output to a volume less than the functional bladder capacity of the enuretic child. The dosage used is 10-40 µg intranasally(26). Significant side effects have not been reported; however, relapse rates are high.

6. Psychotherapy or Counselling

Varying success has been reported with psychotherapy(11) but it probably does not play a major role in the patients who do not have underlying psychopathology. It maybe undertaken as an isolated mode of management or as an adjunct to other specific regimens(4). The goals of counselling include: (a) parental understanding of the multifactorial nature of enuresis; (b) parental acceptance of the child and his symptoms to provide maximum emotional support through positive interaction; (c) instilling in the child and his family the same optimism projected by the clinician; (d) acceptance by the child of his symptom with an appreciation of individual differences that other children demonstrate in other areas of functioning; (e) development of an appreciation on the part of the child that he, and not his parents, is responsible for and can have control over enuresis; and (f) enhancement of the social maturity of the children who demonstrate immaturity in social interactions. The needs of most families are best met by provision of this counselling by the pediatrician, a skilled nurse or a mental health professional. In depth psychotherapy may be indicated when there

is a strong suspicion of significant psychopathology.

7. *Hypnotherapy*

Dramatic improvements in children with enuresis have been reported with hypnosis(17) but it is rarely recommended by physicians for the treatment of enuresis.

8. *Diet Therapy*

It has been reported that serial deletion of certain foods, such as dairy products, chocolate, cola and citrus fruit and juices, from the diet of enuretic children causes significant improvement(14).

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